

**Information Systems Development Support (ISDS) Contract  
Contract Work Order (CWO) Implementation Plan**

for

**CWO 12 - DSN Subsystem Interface Verifier (SIV)**

Developed by  
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Under

**Contract No. 960100**  
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for the

**California Institute of Technology**  
**Jet Propulsion Laboratory**  
**4800 Oak Grove Drive**  
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## Foreword

Due to the timing of these Work Implementation Plans (WIPs) relative to (i.e., subsequent to) the start of the current DSN development efforts, a slightly different approach is being used than would normally be the case. WIPs document the planning that normally precedes development. The document then grows and is modified, if necessary, to reflect a dynamic development environment. Since much of the detail already exists for tasks already in progress at the beginning of the ISDS contract, the WIP references existing detail without significant elaboration. The WIP is envisioned as a central repository to pull together, by reference or inclusion, all the information available for a particular development task. The objective of this exercise is to provide all the information necessary to plan for, then to monitor and control the progress of each development task. This will be done with an eye on improving the total product and reducing redundancy and, thus, paper. Future WIPs will incorporate CASE and other development tools, when authorized, to reduce documentation costs and provide for the integration of the design and documentation processes into a single homogeneous (seamless) process. That is, documentation will be produced as a natural result of the planning, design and implementation process rather than as a separate activity.

## Preface

This is the top-level CWO document used for defining and controlling the effort, organizational structure, management authority and responsibility, and resource allocations for the CWO. This is the baseline for continued enhancement and maintenance of the technical and management document developed under the guidelines set forth in DRD MA005 and in the ISDS Program Management Plan and is supported by the ISDS methodology.

The **order of precedence** is the ISDS contract and attachments, then the ISDS Project Management Plan and its supporting procedures, and then this plan. The ISDS Project Management Plan and supporting procedures can be explicitly waived with the concurrence of JPL and ISDS team management. Such actions and decisions are documented in Section 11, Deviations, Exceptions, and Waivers.

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## 1. Introduction

### 1.1 Background

This Statement of Work extends Telos CWO 48, and is for the maintenance, enhancement, and user support of the DSN Subsystem Interface Verifier (SIV).

The SIV is a test tool that provides a means to simulate and test DSN Subsystem interfaces as defined in interface agreements (820-16 and 820-13). The SIV generates interface data at the bit-level, essentially prototyping an interfacing subsystem without the expense of creating special simulation code for the subsystem. It also receives data from a subsystem, dumps it in a readable format, and validates the head and contents.

Benefits of the SIV include early discovery of interface problems, decreased cost and complexity of interface testing, and improved schedule performance.

### 1.2 Purpose

The purpose of CWO 12 is to maintain and enhance the SIV software and to provide support to its users.

### 1.3 Goals

JPL wants to achieve cost reduction and early identification of equipment and software interface problems. They will use a generic software stimulus-response engine with comparison to prove that new hardware and/or software functions correctly without going to the effort to build a special purpose test rig..

## 2. SOW & Deliverables

### 2.1 SOW

Design, code, test, and document the SIV Build 3 functions:

1. Resolve outstanding SIV Build 2 software anomalies.
2. Modify the SIV Build 2 to support the Advanced DSCC Monitor and Control Subsystem (DMC) software interface testing. *How does this relate to SIV?*
3. Document the design of the software architecture in accordance with the JPL D-4000 standard.
4. Improve the operability of the existing SIV user interface and document the operation of the SIN in a software user's guide.
5. Provide technical support and training to end-users as required.
6. Automate the collection and analysis of metrics for evaluating the cost effectiveness of the SIV.
7. Provide an editor for creating SIV interface definition files.
8. Automate the process of converting bit level interface agreements from the Interface Server into SIV interface definition files.
9. Integrate MSW-TCP/IP to the SIV.

### 2.2 Deliverables

Enumerate all CWO deliverables to assure that both JPL and the CWO team know what is to be produced.

### 2.2.1 CWO Specific Deliverables

2. **Report the results of the SIV metrics evaluation monthly.** *What is this?*
3. Design, code and test Build 3 by 7/30/95.
4. Provide software user's guide and functional capabilities demonstration at each incremental build.
5. Provide final software documentation including SSD and training material by 9/15/95.
6. Provide final functional capabilities demonstration by 9/15/95.

### 2.2.2 Deliverables Required by Contract or Derived from the CWO

1. MA005 - CWO Implementation Plan at Class **XXX** - draft, final, and updates as required  
**1 Produce a Work Implementation Plan (WIP) for the tasks defined in this Statemnet of Work, which includes a detailed schedule for the delivery of items. The WIP is to [be] delivered to JPL 30 days after start of the CWO. The period for accomplishment of the work [is] 12/19/94 - 9/15/95.**
  2. MA006 - Monthly Progress Report
  3. MA007 - CWO Weekly Status and Major Problems Report
- Section Break

## 3. Software Development Plan

## 3.1 Technical Approach

This section contains our technical approach for all phases the CWO. Part of our implementation approach is derived from our analysis of the CWO's risk items and our approach to mitigating them as documented in the Risk Management Plan. The technical aspects of the life cycle phases are discussed in the following sections:

### 3.1.1 Recapitulation of Requirements

We follow these conventions: 1) for traceability each requirement receives a number, 2) **bold words came directly from the CWO SOW**, and 3) normal text is our understanding of the requirement.

#### 3.1.1.1 Functional Requirements

- F1 **For each step of the CWO, all existing capabilities shall be maintained.**
- F2 There shall be **an editor for creating SIV interface definition files.** We interpret this to mean an easy means of creating bit pattern definitions without writing lots of 1s and 0s.
- F3 There shall be an **automated process to convert... bit level interface agreements from the Interface Server into SIV interface definition files.**

#### 3.1.1.2 Performance Requirments

P1

#### 3.1.1.3 Operational Requirements

- O1 **Support the advanced DSCC Monitor and Control Subsystem (DMC) software interface testing.**

- O2 ...document the operation of the SIV in a software user's guide.
- O3 Improve the operability of the existing SIV user interface.

#### 3.1.1.4 Management and Programmatic Requirements

- M1 Provide technical support and training to end-users as required
- M3 Integrate MSW-TCP/IP to the SIV.
- M4 Automate the collection and analysis of metrics for evaluating the cost effectiveness of the SIV. We interpret this to mean "outside of the SIV itself" because the SIV contains no cost information.

#### 3.1.1.5 Special Requirements

- S1 GFE-SIV Build 2 and related documentation for SUN and MODCOMP Platforms.
- S2 Maximize use (porting) of DSN Subsystems Software.
- S3 Document the design of the software architecture in accordance with the JPL D-4000 standard.

#### 3.1.1.6 Definitions

*Term            definition*

----- Section Break

#### 3.1.2 System Operations Concept

*Describe how it works and what the user does with it. A multiple scenario approach including startup, shut down, major operational modes, and error or abnormal operation is often most appropriate.*

#### 3.1.3 Level of Application of the Methodology

The attached check list summarizes our analysis of the technical and management requirements of the CWO and shows how we arrived at a Class XXX application of the ISDS methodology.

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#### 3.1.4 Overall Approach

We have chosen an approach using these available components with known reliability and functionality to significantly reduce CWO cost and risk.

First, we plan to rely heavily on standards (e.g., XWindow System, Motif, C) and standard UNIX services (e.g., TCP/IP, FTP, telnet, file manipulation, multi-tasking) to reduce cost and risk.

Second, we use *list the tools and enumerate their benefits*.

Third, we have chosen *a specific model, and build/release approach with/without rapid prototyping and given a high level description of how this reduces risk*.

Fourth, *if bad thing happens, how we get around it*.

The following subsections describe the five phases of the software development life cycle in detail with respect to the CWO and discuss the most important technical aspects each life-cycle phase.

##### 3.1.4.1 Requirements Definition and Analysis

##### 3.1.4.2 Architectural Design

##### 3.1.4.3 Software Implementation

**3.1.4.4 Software Integration and Test****3.1.4.5 Installation and Training**

There are no special Installation and Training considerations for CWO 00. However,

Because of the size and criticality of the installation and training activities, our plan for this phase is contained in a separate document, xxxxx.

**3.1.4.6 Maintenance and Sustaining Engineering**

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**3.2 Integration & Build Approach**

This section describes our overall approach for integrating software components into releases, testing release functionality, and demonstrating operability to JPL through acceptance testing. There are many possible test documents, but due to the size of the effort (*state the class of this CWO*), some aspects of test planning have been combined. The items to be generated during later stages of the CWO implementation are

**3.2.1 Responsibility**

xxxx is responsible for planning and coordinating overall testing and integration and will ...

**3.2.2 Integration & Test Activities**

*Describe how the integration will occur*

**3.2.2.1 Integration Approach**

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**3.2.2.2 Test Approach****3.2.2.2.1 Scenarios**

----- Section Break

**3.2.2.2.2 Preacceptance Testing****3.2.2.2.3 Acceptance Criteria****3.3 Resources Required**

GFE/GFI resources are described in Section 9

**3.3.1 Development Tools & Resources****3.3.2 Integration & Test Resources****3.3.3 Support Resources****3.3.4 Cost and Schedule Planning****3.3.5 Project Management Tools**

----- Section Break

**3.4 Product Assurance Plan****3.4.1 Configuration Management Plan****3.4.1.1 Introduction**

The CM plan for this CWO is derived from and consistent with the ISDS Project CM Plan. This section is laid out in accordance with CSC SSDM Standard 6107.

**3.4.1.2 Organization & Responsibilities**

The ISDS PAO, is the configuration management officer (CMO). The PAO reports to management independent of the Program Manager and CWOs. The CMO per-

forms configuration management and data activities as outlined in this CM Plan.

The Configuration Control Board (CCB) for this CWO consists of XXXX (representing both the ISDS PAO and CMO), the CWO Task Manager, the ISDS Program Manager and the JPL CWO Manager, at a minimum..

### 3.4.1.3 Configuration Identification

#### 3.4.1.3.1 CI Definition

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**Table 3.5.1.3.1-1  
CWO Configuration Items**

Title or Description	Versions	Notes
CWO Implementation Plan	Draft, Revised, Final	Refer to ISDS CDRL MA 0057 includes plans for Software Development, Development Review, Software QA, CM, Integration and Test, Software Progress Metrics, Staffing, and Cost & Schedule, at a minimum
CWO Weekly Status and Major Problem Report	One/Week	Administrative data including updates to CWO status and schedule
Requirements Documentation	Draft and Final	Includes software, hardware and interface requirements documents and specifications which define the Allocated Baseline
Design Documentation	Preliminary, Detailed, Final	Includes software, hardware and interface development and Product Baseline
Source code/libraries	Internally Configured, Baseline	Source code following peer review approval and QA inspection/certification controlled by 'gatekeeper'; updated for Product Baseline
Executables	Internally Configured, Baseline	Object representation of source code following peer review approval and QA inspection/certification controlled by 'gatekeeper'; updated for Product Baseline
Build Procedures	Draft, Final	Procedures defining software release approach
Test Plans/Procedures and Reports	Draft, Final	Includes test data for CIs, the system, acceptance, and operation
Requirements Traceability (Matrix)	Initial, Design Update, Test Update	Matrix traces requirements from system to CIs (Initial), to design documentation, then to test documentation
Training Materials	Draft, Final	Generated following completion of Operational Baseline
User Documentation	Draft, Final	Generated as part of Product Baseline

Operational Baseline/Version Deliverables	Baselined, Updates	Consists of optional, All approved accreditation
Discrepancy/Change Request Forms/Modifications and Repairs	As Required	This includes System Pr

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#### 3.4.1.3.2 Baselines

### 3.4.1.4 Configuration Control

#### 3.4.1.4.1 Change Classification

#### 3.4.1.4.2 Change Control Procedures

Generally, they will be consistent with the overall CM plan.

Change control for this CWO is fully compliant with the change control procedures in the ISDS CM Plan, with the following exceptions:

#### 3.4.1.4.3 Change Implementation and Verification

#### 3.4.1.4.4 Software Library Control

#### 3.4.1.4.5 Software Support Environment

### 3.4.1.5 Configuration Status Accounting



#### **3.4.1.6 Configuration Audits**

#### **3.4.1.7 Data Management**

#### **3.4.1.8 Configuration Management Tools**

#### **3.4.1.9 Records Collection and Retention**

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### **3.4.2 Software Quality Assurance Plan**

The QA Plan for this CWO is derived from and consistent with the ISDS Program QA Plan.

#### **3.4.2.1 Scope**

#### **3.4.2.2 Evaluation of Products**

#### **3.4.2.3 Verification of Processes**

#### **3.4.2.4 Course Correction**

QA is responsible for determining when problems are not being resolved to the customers satisfaction and reporting this to the CWO manager and program manager.

#### **3.4.2.5 Productivity and Quality Goals**

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### **3.4.3 Review Plan**

#### **3.4.3.1 Timing and Location of the Reviews**

Formal reviews will be held at the IDI ISDS facility or at the JPL facility.

#### **3.4.3.2 Notification, Agenda and Attendees**

The CWO manager, XXX will be responsible for notifying JPL in advance of a proposed review and providing an agenda and list of proposed attendees.

#### **3.4.3.3 Minutes and Action Items**

The PAO is responsible for keeping minutes and action items, for posting them in the CWO database, and for routing them to the responsible parties. The responsible parties will return the proposed resolution to *CWO manager* for review and approval.

*CWO manager* will provide a draft set of minutes and action items within one week of the review and will continue to report the status of action items on a weekly basis to his JPL counterpart until all action items have been resolved.

----- Section Break

### **3.4.4 Documents**

#### **3.4.4.1 Installation & Training Plan**

#### **3.4.4.2 Installation Plan**

#### **3.4.4.3 Training Plan**

----- Section Break

#### **3.4.4.4 Maintenance and Sustaining Engineering Plan**

##### 3.4.4.4.1 Operational and Maintenance Requirements

##### 3.4.4.4.2 Operational and Maintenance Procedures

#### 3.4.4.4.3 Operational and Maintenance Guides

*The operational guide is the User Manual, the Maintenance Guides the CWO name requirements and design specifications. This section merely lists the documents with its precise title and its document control number .*

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## **4. Management Approach**

The management approach for this CWO is derived from and is consistent with the ISDS Program Management Plan. CWO specific items are limited to the WBS, the details of the CWO, and ...

### **4.1 Subcontractors**

#### **4.1.1 Computer Sciences Corp (CSC)**

We will have a short paragraph about the Virtual corporation, Subcontract Vehicle, Performance Assessment, Interface in here.

#### **4.1.2 Affiliates/Consultants**

Make a separate section for each and list the justification or rationale for using such an arrangement.

### **4.2 Contract Change Management**

#### **4.2.1 Directed Changes**

#### **4.2.2 Claims for Adjustment**

#### **4.2.3 Anticipated Changes**

## **4.3 Tracking the Work**

The ISDS team's approach to measure software development effort is based on "earned value". "Earned value" for this CWO is discussed in detail in Section nnnn.

### **4.3.1 Technical Performance Measurement**

### **4.3.2 Earned Value Measurement Methods**

### **4.3.3 Cost and Schedule Performance**

## **4.4 Refine Estimates**

We refine our estimates in two ways. First, earned value techniques allow us to reflect experience (for better or for worse) in one task phase into a subsequent phase. Second, cost and schedule estimation is an agenda item at each major review to make the estimates and their assumptions visible to both JPL and ISDS team, a "no surprises" approach to CWO management.

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## **4.5 Software Progress Metrics Plan**

The software progress metrics plan to Manage the CWO and to improve our processes is that describe in the project metrics plan with the following exceptions:

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## **5. Risk Management Plan**

Risks specific to this CWO are presented in the following two tables. The first, Table 5-1, enumerates the high level risks associ-

ated with this CWO and with most CWOs.. The second, Table 5-2, enumerates the risks, impact, and the technical and managerial mitigation strategies for this CWO if the assumptions made in Section 1.3 do not hold.

In a table or in a list. For each risk show Risk Description, Affected Project Areas, Risk Tracking Method, Risk Mitigation, Decision Milestones, Risk Bounds.

**Table 5-1 - High Level Risks for the CWO and How the ISDS Team Significantly Mitigates their impact on JPL**

Type	Factor	CWO
known	CWO terms & conditions	Schedule
		Acceptance Criteria JPL review & approval
	Assumptions	Skill mix, Productivity Software sizing
		Technical Assumptions
potential	Commitments	GFE availability and quality
	Technical / Management	Estimates & assumptions
		Later expansion and elaboration of requirements
		Interpretation of requirements & specifications
	New technology	Availability of key personnel
		Adaptation required
Unknown	Knowledge loss at CWO end	Availability
		Training required
	--	Inability to respond to problems or change requests
		Changing funding & priorities
		Changing requirements
		Key personnel attrition

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**Table 5-2 CWO Requirements Risks, Impact, and Mitigation Strategies**

CWO Assumption does not hold and ..	Impact if Risk Realized
Powerful GUI builder and widget library not available	Sizing estimate too small by factor of 3. Productivity estimate too high. Proposed cost & schedule impossible.

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## 6. Work Breakdown Structure (WBS)

*Use the standard WBS*

----- Section Break

## 7. CWO Organization and Staffing

This section of the CWO Implementation Plan shows our staff and schedule estimates and describes the processes used to create and refine them. Figure xxx shows the CWO implementation schedule against the WBS.

### 7.1 CWO Staff Names, Qualifications, & Availability

*List them*

### 7.2 CWO Organization

Figure 6.2.1 shows the CWO task organization.

#### 7.2.1 CWO in the ISDS Project Organization

#### 7.2.2 CWO in the JPL Organization

### 7.3 Staffing Profile

Table nnn shows the personnel loading required for the CWO. This is probably linked in from another application.

### 7.4 Estimation Approach

#### 7.4.1 Size Estimation

#### 7.4.2 Underlying Assumptions for the Sizing Estimate

*List each assumption.*

Section xxxx, Risk Management, describes the effects on the estimates should these assumptions not hold..

#### 7.4.3 Overall Staff Profile and Schedule

Figure nnn shows the CWO schedule. Describe the salient points of figure nnn. This is probably linked in from another application.

#### 7.4.4 Maintenance (Sustaining Engineering) Effort

*If there is a maintenance effort between builds and releases or after to final delivery, then include an estimate here.*

There will be between xK and yK lines of code to maintain at each release. Using a (COCOMO defensible) number of 20000 Source Lines of Code (SLOC) per staff year and not having a significant requirement change, between nn and mm staff years per year are required for ongoing maintenance. We used (some value between nn and mm for....

#### 7.4.5 Smooth the Schedule and Staff Profile

*Describe any such smoothing here.*

### 7.4.6 Apply the Staffing to the WBS

Figure xxx shows the staff members allocated to the WBS elements..

----- Section Break

## 8. CWO Schedule and Dependencies

### 8.1 Schedule

### 8.2 Dependencies

Dependencies are those items outside the control of the CWO manager. We identify them here so we can plan for and manage them. Critical dependencies, if any, are included in the Risk Management Plan.

There are only a few some many dependencies on this CWO. They are:

- Mission constraints: None
- JPL facilities:
  1. Within each category, number them like this if there is more than one. Don't forget training and communications requirements.
- JPL support: *This is for items for which they are critically responsible*
- User availability: *When in the program and why*
- Site personnel: *When and why*
- GFE/GFI:
  2. Availability of computer and software within planned schedule.

----- Section Break

## 9. GFE/GFI Items

----- Section Break

## 10. Close-out Plan

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## 11. Deviations, Waivers, & Exceptions

This section of the CWO Implementation Plan will contain only deviations known at the time of the plan. The list and details of the deviations and exceptions and their waiver status is maintained in the problems data base and reflected in applicable CWO documents (e.g., Software Specification) as applicable.

This CWO has no deviations to established standards and procedures.

----- Section Break

## 12. Appendices

The appendices contain the process descriptions and data dictionary entries for items that appear on System Models, Data Flow Diagrams, and Structure Charts. They are organized alphabetically to make them easy to find and are presented in “structured English” to simplify communication.

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### 12.1 Process Descriptions

This contains the analysis, typically the structured analysis.

----- Section Break

### 12.2 Module Specifications

This section contains the design and module descriptions

----- Section Break

### 12.3 Data Dictionary

The Data Dictionary Entries (DDEs) define the content of the data used by the CWO. The DDEs presented below are a superset of the definitions, data flows and data couples that appear on the models, Data Flow Diagrams, screen definitions, and Structure Charts included in section 1.4 of the CWO Implementation Plan.

*If no CASE tool was used, then*

The text within this data dictionary is a variant of Backus-Naur Form (BNF). The entries are arranged alphabetically without regard to case, the same way an English dictionary is arranged. Some definitions are English text and some use the following notational conventions:

$::=$  is read as "is defined as"

$+$  is "and".  $a+b$  means both  $a$  and  $b$

$|$  means "exclusive or".  $a|b$  means either  $a$  or  $b$ , but not both

$[]$  means optional

$m[]n$  means at least  $m$  but no more than  $n$  of them are required. Using  $n$  instead of a number for the maximum means an undefined number of repetitions are permitted.

$[]n$  means optional but there can be more than one.

$()$  Parentheses are used to clarify grouping